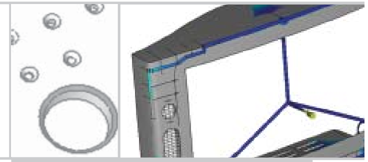
MPI/Gas



MPI/Gas simulates the gas-assisted injection molding process, where gas, usually inert nitrogen, is injected into the polymer melt.

The gas drives the polymer through the mold cavity to complete mold filling and create a network of hollow channels throughout the component. Combine MPI/Gas with MPI/Cool, MPI/Fiber, and MPI/Warp to help determine where to put polymer and gas entrances, how much plastic to inject prior to gas injection, where to place gas channels, and how large to size them.

Capabilities

MPI/Gas allows you to:

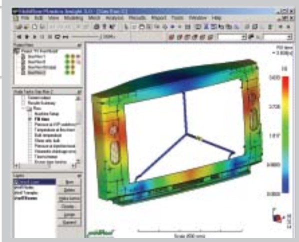
- Evaluate the filling pattern with the influence of gas injection to aid in part design, gate placement, and process setup
- Link to MPI/Cool to evaluate mold cooling with the influence of gas injection to optimize mold cooling design and minimize cycle time
- Link to MPI/Warp to predict part shrinkage and warpage with the influence of gas penetration to determine final part quality
- Link to MPI/Stress to apply in-service loading to determine part performance with gas channels
- Properly size gas channels for optimal filling and gas penetration
- Determine the best gas channel layout to control gas penetration
- Inject gas at any location or in multiple locations within the part or runner system
- Inject gas through multiple gas pins simultaneously or at different time during the process
- Detect areas of poor gas penetration or other problems
- Determine the proper shot size to avoid gas "blowout"
- Optimize injection speed profile for the plastic injection stage
- Determine injection pressure and clamp force requirements for proper molding machine selection
- Incorporate delay time prior to injecting gas allowing thin areas to solidify
- Automatically determine gas pressure required to avoid short shots, melt-front hesitation, or burning
- Determine final part weight after gas injection to help maximize material savings and minimize weight
- Estimate the final wall thickness after gas penetration
- Accurately identify weld (knit) and meld lines based on part design and gate placement
- Accurately identify air traps for proper mold venting

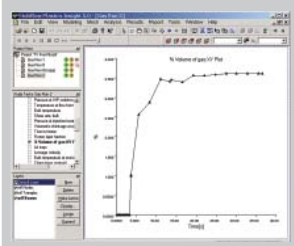
Supported Model/Mesh Types:

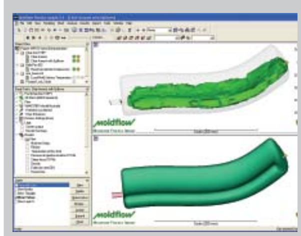
- Finite-element midplane models
- True 3D Solid models (add-on option)

Supported Analysis Integrations:

- Requires MPI/Flow
- Links to MPI/Cool (midplane models only)
- Links to MPI/Fiber
- Links to MPI/Warp (midplane models only)
- Links to MPI/Stress (midplane models only)







DESIGN ANALYSIS SOLUTIONS

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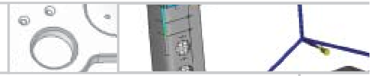
MPI/Gas Features



- Numerical solution based on a hybrid finite-element/finite-difference method for solving the pressure, flow, and temperature fields, and a control-volume method to track moving melt fronts
- Comprehensive, 7-constant Cross-WLF viscosity model accounts for the effects of temperature, shear rate, and pressure
- Definitive, 13-constant, 2-domain Tait equation pvT model captures the effects of temperature and pressure on density (specific volume)
- Accurate prediction of juncture pressure loss (due to abrupt change in runner/gate size) using the Bagley correction
- Conjugate-gradient (CG) pressure solver is the fastest and most accurate technology available for filling simulations

Filling Analysis:

- MPI/Gas analyzes the polymer injection phase, with melt filling the cavity partially or completely as required. Process conditions, runner and cavity flow balancing, and material selection can all be optimized with MPI/Gas
- Once the polymer injection phase is complete, analysis of the gas injection phase begins at a user defined time or cavity fill level
- Independent gas and polymer injection locations can be selected
- MPI/Gas simulates pressure increase or decrease during the injection phase, followed by the gas pressure history as gas expands into the melt

Packing Analysis:

- MPI/Gas simulates the advancement of the gas flow front during the packing phase, as the gas compresses the melt, compensating for polymer shrinkage
- MPI/Gas predicts the location of gas "blow-through" of the polymer flow front during fill, which results in short shots and unacceptable part quality
- Gas penetration also alters polymer skin thickness and can affect localized part strength. MPI/Gas predicts polymer wall thickness and gas channel diameter along the gas path and into thinner wall sections

Results:

- Polymer fill pattern
- Gas channel route during filling
- Gas channel advancement during packing
- Gas blow-through locations
- Weld-line positions
- Location of air traps
- Gas penetration into thin wall sections (fingering)
- Polymer wall/gas channel thickness
- Gas and polymer pressure profiles during cycle
- Cavity fill rate
- Clamp tonnage requirement

Fiber Analysis:

- Fibers play an important part in the design and manufacture of plastic parts. MPI/Gas integrates with MPI/Fiber to accurately predict the orientation of fibers and the thermo-mechanical property distribution in gas-assist molded parts

Cooling Analysis:

- The cooling characteristics of gas-assist injection molded components can vary considerably from those of a similar component produced without gas, and as such, the tooling requirements need to be tailored to suit both the component and production conditions. MPI/Gas interfaces with MPI/Cool to optimize the mold and cooling circuit design to achieve uniform component cooling within the minimum cycle time

Warpage Analysis:

- MPI/Gas links to MPI/Warp to accurately predict the shrinkage and warpage of the gas-assist molded part. MPI/Warp can be used to determine how the gas channel design, layout, and sizes affect the post-molding shrinkage and warpage of the final part

3D Gas-Assisted Analysis:

- MPI/Gas interfaces with MPI/3D to simulate the filling and packing phases using a 3D tetrahedral mesh
- Using 3D tetrahedral mesh eliminates the need to employ special modeling techniques to represent gas channels
- Reduces modeling time and improves accuracy of analysis mesh
- Investigate the effects of overflow wells in the gas-assisted injection molding process

Global Headquarters
Moldflow Corporation
492 Old Connecticut Path
Suite 401
Framingham, MA 01701
USA
Tel: +1 508 358 5848
Fax: +1 508 358 5868

For further information about Moldflow® Design Analysis Solutions, Manufacturing solutions, services and global office locations, visit www.moldflow.com.

Local office address: